Lung Cancer Detection By Using CNN Method: A Review

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Abstract:

Medical Image Processing Modern three-dimensional (3-D) medical imaging offers the potential and promise for major advances in science and medicine as higher fidelity images are produced. Due to advances in computer aided diagnosis and continuous progress in the field of computerized medical image visualization there is need to develop one of the most important fields within scientific imaging. There are number of types of cancers exist out of that lung cancer is one of the most common cancers. Cancer patients are increasing day by day due to the lifestyle of people. In both man and women lung cancer has become the second most common cancer which causes death. From the early basis report on cancer patients it has been seen that more number of people die of lung cancer than from other cancers such as colon, breast and prostate cancers combined. Lung cancer are related to smoking (or secondhand smoke), or less often to exposure to radon or other environmental factors that's why this can be prevented. But still it is not yet clear if these cancers can be prevented or not. In this research work, approach of segmentation, feature extraction and CNN will be applied for locating, characterizing cancer portion.

Keywords:

Image Visualization, Fidelity image, CNN

Introduction:

1.1 Introduction to Image Processing

The image processing is a technique which is used for the enhancement of unprocessed pictures or images captured from different cameras from different origins. With the help of image processing, the significant data can be retrieved efficiently. In the last few years, various methods have been evolved in image processing techniques for the extraction of complicated information in an effective manner. The image processing technology is utilized by several operations in the last few yes. This approach is widely utilized in army, clinical and investigational areas. Some associations also use image processing approach for simplifying the manual workload and execution of positive actions.

The image processing is applied inside numerous applications inclusively in order to improve the optical description of pictures. For the preparation of pictures, different calculations are implemented as well. The other name given to the image processing is digital image processing. The digital image processing comprises both visual and analog image processing. The digital image processing involves different methods. Image acquisition is the other name given to the imaging. The visual and digital image processing

can be performed with the help of imaging. This technique utilizes several domains like computer graphics for the generation of pictures. This technique also provides assistance in the manipulation and modification of pictures. The picture or image is analyzed with the help of processor hallucination or computer vision [1].

1.1.1 Image processing techniques

Following are the different image processing techniques:

Image representation: The representation of whole data is done in binary form in computing in a logical way. This is true for images, numbers and text. Nevertheless, a significant difference should be made amid the way of image data screening and storing. The demonstration of bitmap is involved in display while several formats of image, likewise, jpeg are involved in storing as a file.

Image preprocessing: The noise and inappropriate, visibly redundant information are removed using image preprocessing. The noise can be defined as redundant information. The noise can arise from the image acquisition procedure.

Image enhancement: Occasionally, the images achieved from satellites and traditional digital cameras may be short in contrast and intensity. This happens due to the restrictions of imaging sub systems and lighting situations during image taking. Various sorts of noises may occur in the image [3].

Image restoration: The degradations within the picture are reduced or minimized by the image restoration technique. These de-blurring images tainted due to the limits of a sensor or its surroundings, noise filtering, and rectification of geometric deformation or non-linearity by sensors, etc. are involved in this technique. This technique is quite popular in shooting domain or publishing. In these scenarios, an image degraded due to some reasons should be enhanced prior to its printing.

Image analysis: This technique is related to the creation of quantitative measurements from a picture for generating a depiction of this picture. The retrieval

of certain features is required by this technique. These features help to detect the object. The image data manipulation is involved in this technique for the exact determination of the information essential to resolve a computer imaging difficulty. In general, this scrutiny is a part of a superior procedure. This process is iterative in nature and permits to give solution to the application explicit equations. Mainly, This is a data lessening procedure. In order to separate the preferred object from the sight, the segmentation methods are utilized. Classification and image description are allowed by the quantitative measurements of object features.

1.1.2 Benefits of image processing:

Following are the some benefits of image processing:

The non-visible objects are identified with the help of visualization.

Image processing is quicker and economical.

This technique is free from noise.

Image processing involves image sharpening and image restoration. These techniques are used to generate an improved image.

From the database, the images can be extracted effortlessly.

1.2 Introduction to Lung Cancer Detection

In lung cancer, anomalous cells multiply and grow in the form of a tumor. The lymph fluid which environs lung tissue carries the cancerous cells from lungs to blood. The lymph streams via lymphatic vessels. These lymph fluid drains into lymph nodules deployed in the lungs and in the middle region of chest area. The growth of lung tumor always carried out towards the middle area of chest due to the regular flow of lymph fluid towards the chest center. When a cancer cell leaves its origin area, metastasis happens. This cancerous cell now goes towards a lymph nodule or to different body part with the help of blood flow. The prime lung tumor is a kind of cancer which originates from the lung [3].

Literature Review:

Amir Roointan, et.al (2019) reviewed the development of inclusive molecular description of tumor lump [14]. It was clarified that that a fundamental role was played by the ailment biomarkers in the early detection and indulgent of tumor analysis. The presented work summarized the speedy development of biosensor equipments for lung tumor biomarkers discovery. In the near future, these intellect plans can have huge consequences on scheduled medical scrutiny of biomarkers of pharmacogenomics and pharmacogenetics importance. It was also noticed that more expansion in nanobiotechniques in association with nanobiocomposite and miniaturization approaches would considerably improve existing biodiagnostic capability for sensing tumor biomarkers in genuine organic models with sufficient compassion, actueness, sturdiness and price efficiency.

Jing Songa, et.al (2019) proposed a novel approach of microscopic hyperspectral imaging for the identification of ALK affected lung tumor [15]. In this approach, a household microscopic hyperspectral imaging scheme was utilized for capturing the pictures of five classes of lung tissues. For the minimization of noticeable banding clamor and sound element from authentic information, a preprocessed algorithm was introduced. After this, a combination of support vector machine, mass study and clumping processing was used for the projection of a segmentation algorithm. The variation of ethereal graphs, virtual amount amid cytoplasm and cell core was utilized for the differentiation of the fluctuation of spectral curves and the relative proportion between cytoplasm and cell nucleus for the ALK affected and non-affected lung cancers. The tested outcomes demonstrated that ALK affected set contained 77.3% comparative amount of cytoplasm while the ALK positive set contained 40.6% cytoplasm comparative quantity. The investigational outcomes related to quantitative scrutiny and ethereal curves demonstrated that the treatment of ALK affected lung tumor implemented with low concentrated medicines would be developed towards the ALK non-affected lung tumor.

Guobin Zhang, et.al (2019) presented a serious evaluation of the CADe scheme for automated lung cancer recognition with the help of CT descriptions for summarizing the existing developments [16]. In the initial stage, a brief description of CADe scheme was provided. After this, a comprehensive summary of the five main mechanisms in CADe scheme was offered. These mechanisms included information attainment, preprocessing, lung image segmentation, nodule recognition and false positive diminution. A brief summary of superior nodule detection methods and classifiers was also provided on the basis of understanding, false positive value and other constrained data. After different studies it was evaluated that CADe scheme was essential for timely lung malignancy recognition.

Moritz Schwyzer, et.al (2018) estimated the usefulness of machine learning for lung tumor recognition in FDG-PET imaging in the scenario of ultralow amount PET scan [17]. In the absence of pulmonary tumor, the recital of artificial neural network on selective lung cancer patients was examined. The sensitivity rate of 95.9% and 91.5% was attained by the artificial neural system for lung cancer detection. The artificial neural network achieved precision of 98.1% and 94.2%, at average dosage and ultralow dosage PET 3.3%, correspondingly. The tested outcomes demonstrated that machine learning approach provided assistance to the completely automatic lung tumor recognition at extremely small and efficient radiation dosages of 0.11 mSv. It was also suggested that more advancements in this technique could enhance the accurateness of lung tumor testing approaches.

Suren Makajua, et.al (2017) stated that CT images could be used for the lung tumor recognition. The major objective of this study was the evaluation of different automated technologies, investigation of existing finest method, recognition of its restrictions and disadvantages and the projection of a decisive system with several advancements [18]. For this purpose, the lung tumor recognition approaches were classified on the basis of their lung cancer analyzing accurateness. In every stage, these lung cancer recognition methods were examined and their

restrictions and disadvantages were considered. It was identified that different lung cancer detection techniques showed different precision. Some techniques showed least precision rate while some techniques showed good precision rate for lung cancer detection but no technique showed 100% precise lung cancer detection.

Madhura J, et.al (2017) presented a review of noise reduction approaches for lung cancer diagnosis [19]. It was stated that lung cancer was a solemn ailment which caused due to the abnormal growth of cells in the lung tissues. Amongst all the other kinds of tumors, the lung tumor was identified as the most incident cancer. Therefore this cancer became the reason of several cancer patients' deaths. The early recognition of lung cancer was very important for protecting various lives. The presented review study demonstrated a brief overview of lung tumor. This review work also described the different kinds of noises present in the pictures, techniques for the attainment of apparent pictures and noise elimination methods. A brief review on the existing noise elimination methods was also provided in this paper.

K.Punithavathy, et.al (2015) developed a methodology for automatic detection of lung cancer from PET/CT images [20]. Image pre-processing methods such as Contrast Limited Adaptive Histogram Equalization (CLAHE) and Wiener filtering were performed to remove the artifacts due to contrast variations and noise. Lung region of interest (ROI) were extracted from images using morphological operators. Haralick statistical texture features were preferred as they extract more texture information from the cancer regions than the visual assessment. Fuzzy C means (FCM) clustering was used to classify the regions as normal or abnormal. The proposed method was carried out using PET/CT images of lung cancer patients and implemented using MATLAB. The performance of the proposed methodology was evaluated using Receiver Operating Characteristics (ROC) curve. The proposed method provides better classification and cancer detection with an overall accuracy of 92.67%.

Problem Formulation and Proposed Methodology:-

Problem Formulation:

The image processing is the approach which can process digital information stored in the form of pixels. The medical image processing is the field of image processing in which medical information like MRI images, CT images are processed. This research work is related to lung cancer detection from MRI images. The lung cancer detection techniques have various phases which are pre-processing, segmentation, features extraction and classification. In the phase of pre-processing noise from the input image is removed and in the segmentation phase, the image will be segmented into certain parts from further processing. In the third phase, the approach of features extraction will be applied which extract features of input image. In the last phase, the technique of classification will be applied which will classify tumor and non tumor portions. In the previous years, many techniques are designed for the lung cancer detection which are based on neural network approach. In the designed techniques, the problem exits of tumor localization and characterization. The technique for lung cancer detection designed by Alexis Arnaud solves the problem of tumor localization and characterization. The designed technique has high complexity due which execution time is very high. The techniques need to designed which can localize and characterize tumor portion accurately and in least amount of time.

Objectives:

It is important to detect the tumor portion accurately by localization and characterization. The CT scan data is very complex due which approach is required which can locate tumor portion from the image. Following are the various objectives of this research work to locate tumor portion from the CT scan images:-

1. Implement fully automated lesion localization and characterization method for lung cancer detection in CT scan images

2. Evaluate performance of automated lesion localization and characterization method in terms of accuracy, precision, recall and execution time

3. Design textural feature extraction and CNN based method for the lung cancer localization and characterization in CT scan images

4. Implement designed approach and compared with fully automated lesion localization and characterization method in terms of accuracy, precision, recall, execution time.

Proposed Methodology

This research work is related to lung cancer detection from the CT scan image using image processing techniques. The proposed methodology has the four phases for the lung cancer localization and characterization. Following are the various phases of the lung cancer detection:-

This research work is related to lung cancer detection from the CT scan image using image processing techniques. The proposed methodology has the four phases for the lung cancer localization and characterization. Following are the various phases of the lung cancer detection:-

1. Pre-processing:- The pre-processing is the first phase in which CT scan image is taken as input. The technique of image de-noising will be applied which will remove noise from the input image.

2. Segmentation:- In the second phase, the approach of region based segmentation will be applied which will segment the similar and dissimilar regions from the CT scan image The outh's segmentation technique is applied for the segmentation. The sectioned picture attained from thresholding comprises several benefits like lesser storage space, speedy dispensation velocity and easiness in exploitation in comparison with gray level picture that generally includes 256 steps. In the presented work, a gray scale picture is utilized for thresholding process. In this process, rgb picture is converted into binary picture. The obtained picture is in the form of black and white.

3. Feature Extraction:- The feature extraction is the third phase, in which GLCM algorithm will be applied for the feature extraction of the CT scan image In this step, the GLCM algorithm is applied for the feature extraction. The GLCM algorithm will extract the textural features of the input image. The GLCM algorithm extracts 13 features of the image for the tumor detection

$$\text{Energy} = \sqrt{\sum_{i,j=0}^{N-1} p_{i,j}^2}$$

$$\text{Entropy} = \sum_i p_i \log_x i$$

$$\text{Contrast} = \frac{I_{max} - I_{min}}{I_{max} + I_{min}}$$

4. Classification:- In the last phase, the approach of CNN will be applied which can categorize and localize the cancer part. All the data points of an individual class are separated by the best hyper plane, this can be identified through the classification provided by CNN. In the CNN the largest the best hyper plane is described by the largest margin between the two classes. There are no interior data points when there is maximum width between the slabs parallel to the hyper plane which is also known as margin. The maximum margin in hyper plane is separated by the CNN algorithm

Conclusion:

For lung cancer detection image processing is used. There are three steps for the detection of cancer nodule. To detect the presence of cancer nodule CT scan images are used. Further the pre-processing composed of two processes. Image enhancement and image segmentation are that two processes. For human viewer interpretability of information in the image is improved by image enhancing step. There are many enhancement algorithms such as Gabor filter, fast fourier transform, log gabor filter and auto enhancement. In pre-processing second step is Image segmentation. The purpose of image segmentation is to partition the image into meaningful region and to identify the object or relevant information from the digital image. The output from the segmentation process is goes to feature extraction stage. Features

such as area, perimeter and irregularity are found out in feature extraction. On the basis of the extracted features the abnormality in lung are found out by the cancer cell identification module. The approach of GLCM and CNN will be used in this research work for localizing and characterizing cancer portion from the CT scan image. The proposed approach is implemented in MATLAB and results are analyzed in terms of accuracy. It is analyzed that with the proposed approach results are optimized upto 8 percent.

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